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(54) **Low cost fabric softeners for rinse cycle using triglyceride-based ester quats**

(57) An improved rinse cycle fabric softener concentrate and formulation that comprises a blend of the following quaternary ammonium compounds about 1 to about 50 weight % of at least anionic scavenger; and about 50 to about 99 weight % of at least one triglyceride-based ester quat. The triglyceride-based ester quat is produced by reacting a vegetable and/or animal based fatty oil with an alkanol amine and thereafter quaternizing the ester amine in the presence of an alkylating agent.

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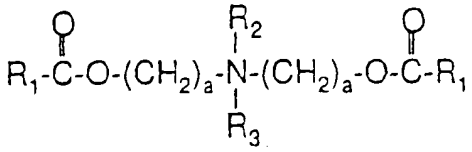
Description

Field of the Invention

[0001] The present invention relates to fabric softeners, and more particularly to fabric softener concentrates and formulations that are added during the rinse cycle of a laundering process. Specifically, the present invention is directed to a rinse cycle fabric softener concentrate that comprises at least one anionic scavenger and at least one triglyceride-based ester quaternary ammonium (quat) compound. The rinse cycle fabric softener concentrate of the present invention provides improved performance, i.e., softening, dye transfer inhibition and water dispersibility at a lower manufacturing cost than heretofore possible with prior art fabric softeners that are based on quaternized fatty acid di- or trialkanol amine ester salts.

Background of the Invention

[0002] In the field of laundering, it is well known to add a liquid fabric softener containing at least one softening agent such as a cationic quaternary ammonium compound or salt thereof directly into the laundering process. An example of a typically prior art fabric softener agent is an ester quat having the following formula:



wherein each R_1 is the same or different and is a C_{8-22} alkyl; R_2 and R_3 are the same or different and are hydrogen, C_{1-6} hydrocarbyl group or a hydroxy alkyl such as hydroxy ethyl or hydroxy propyl; and a is from 1 to 6, preferably 2 to 3. The term "hydrocarbyl" is used herein to denote aliphatic (i.e., a linear or branched, saturated or unsaturated hydrocarbon group, that is, alkyl, alkenyl and alkynyl groups), cycloaliphatic, aryl, alkaryl and aralkyl groups. Salts of the above illustrated ester quats are also known and have been used in the capacity as a rinse cycle fabric softening agent.

[0003] The prior art ester quats are typically prepared by reacting a trialkanol amine (triethanol amine) with a fatty acid to produce an ester amine and thereafter the ester amine is quaternized in the presence of a quaternization agent such as DMS (dimethyl sulfate) or methyl chloride to produce the ester quat. Prior art fabric softener agents produced in the above manner are generally quite unstable since the reaction sequence results in the formation of many unwanted by-products. Moreover, the prior art fabric softener agents produced utilizing fatty acids are expensive and are oftentimes unreliable.

[0004] The addition of the liquid fabric softener typically occurs during the rinse cycle itself. Although some improved softness may arise from the use of prior art fabric softeners, the overall softening performance of prior art fabric softeners is hindered due to high levels of residual anionics which are typically present in the washing liquor; the high level of residual anionics in the laundry liquor is the result of utilizing detergents that contain a high concentration of anionic surfactants which are not typically removed prior to the rinsing cycle. This is particularly the case in North America wherein high levels of anionic surfactants are employed in the detergent, and little or no rinsing occurs prior to the addition of the fabric softener.

[0005] The hindered softening performance of prior art fabric softeners can be attributed to the high affinity that the cationic softening agents have for negatively charged species and/or surfaces. When high levels of anionics are present in the laundering liquor, the anionics compete with the negatively charged surfaces of the laundered fabric for the cationic fabric softener agent and complexation of the anionics and the cationic fabric softener agent occurs. Complexation of the anionics with the cationic fabric softener agent is undesirable since it significantly reduces the overall amount of fabric softener agent present in the rinse cycle which is needed to obtain a high degree of softening. Thus, because of the reduced levels of fabric softener agents in the laundry liquor, prior art fabric softeners can not achieve a high degree of softness.

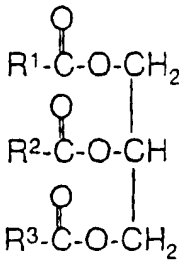
[0006] In view of the drawbacks mentioned hereinabove with prior art rinse cycle fabric softeners, there is a continued need to develop new and improved rinse cycle fabric softener concentrates and formulations that exhibit improved performance, i.e., softening, dye transfer inhibition and water dispersibility, at a lower manufacturing cost than heretofore possible with prior art fabric softeners that are based on quaternized fatty acid di- or trialkanol amine ester salts.

Summary of the Invention

[0007] The present invention is related to an improved rinse cycle fabric softener concentrate that comprises a blend of the following quaternary ammonium compounds:
(i) about 1 to about 50 weight % of at least one anionic scavenger, and (ii) about 50 to about 99 weight % of at least one triglyceride-based ester quat.

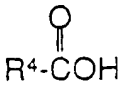
[0008] The term "triglyceride-based ester quat" is used herein to denote any ester quat that is produced by

reacting an alkanol amine with a vegetable and/or animal based fatty oil, i.e., triglyceride, having the formula:



wherein R^1à, R^2à and R^3à are the same or different and are linear or branched, saturated or unsaturated, C_9-C_{21} alkyl or a linear or branched C_1-C_4 alkyl, with the proviso that at least one of R^1à, R^2à or R^3à is a linear or branched C_9-C_{21} alkyl, to produce an ester amine and thereafter quaternizing the ester amine in the presence of an alkylating agent. In a preferred embodiment, at least two of R^1à, R^2à or R^3à are linear or branched C_9-C_{21} alkyls. In an even more preferable embodiment of the present invention, each of R^1à, R^2à or R^3à is a linear or branched C_9-C_{21} alkyl.

[0009] In some embodiments of the present invention, the triglyceride may be used in conjunction with a fatty acid having the formula:



wherein R^4àCO is an aliphatic, linear or branched acyl radical containing from 5 to 21 carbon atoms.

[0010] The mole ratio of triglyceride to alkanol amine employed in producing the triglyceride-based ester quat is from about 0.5:1 to about 1.5:1, preferably from about 0.6:1 to about 1:1, and most preferably from about 0.7:1 to about 1:1.

[0011] The rinse cycle fabric softener concentrate of the present invention may be used with conventional liquid carriers such as water; C_{1-4} monohydric alcohols; C_{2-10} polyhydric glycols, diols or triols; polyalkenylene glycols; and mixtures thereof to form a liquid rinse cycle fabric softener formulation. In this embodiment of the present invention, the concentration of the inventive rinse cycle fabric softener concentrate in the liquid fabric softener formulation is from about 2 to about 40 weight %.

[0012] The rinse cycle fabric softener concentrate or liquid fabric softener formulation of the present invention is used in the rinse cycle of any laundering process wherein conventional detergents are employed. In one embodiment of the present invention, the inventive concentrate or formulation is used in a laundering liquor wherein the detergent contains a high level of anionic surfactants present therein. The term "high level of anionics" refers to a detergent composition that contains at least 10% or more of an anionic surfactant present therein. The rinse cycle fabric softener formulation of the present invention is used in an amount of from about 0.05 to about 0.4 weight % of said fabric softener formulation, per 100 grams of fabric to be laundered.

[0013] The inventive rinse cycle fabric softener concentrate or formulation is effective in preventing dye transfer and improving the softness of a laundered fabric. Moreover, the presence of the anionic scavenger in the fabric softener increases the water dispersibility of the active agents present in the fabric softener. The increased water dispersibility results in a higher solids rinse cycle fabric softener formulation that contains up to 25% of softening actives present therein. More preferably, the rinse cycle fabric softener formulation of the present invention contains from about 2 to about 40 % of softening actives present therein.

[0014] In another embodiment of the present invention, a clear concentrate is provided. Specifically, the clear concentrate comprises at least one anionic scavenger and at least one oil-based ester quat selected from triglycerides containing unsaturated fatty acids having 0, 1, 2 or 3, preferably 1; double bond and an iodine value of from 40 to 150. Examples of such oil-based ester quats include, but are not limited to: canol, soybean and other like vegetable oils which are reacted with an alkanol amine and thereafter quaternized.

[0015] The clear concentrate can be used to form a clear formulation containing at least one of the above-mentioned liquid carriers and optionally a conventional surfactant (anionic, nonionic, amphoteric and/or zwitterionic) and/or a conventional detergent salt.

[0016] When used in a clear formulation, the formulation may include up to 65% of softening actives present therein.

Detailed Description of the Invention

[0017] As stated above, the present invention is directed to a rinse cycle fabric softener concentrate and formulation which include a blend of quaternary ammonium compounds that comprises at least one anionic scavenger

and at least one triglyceride-based ester quat. The at least one triglyceride-based ester quat is used in the present invention as a cationic softening agent and is used in place of conventional ester quats that are based on the reaction of alkanol amines and fatty acids.

[0018] The fabric softener concentrate of the present invention contains from about 1 to about 50 weight % of the at least one anionic scavenger and from about 50 to about 99 weight % of the at least one triglyceride-based ester quat. In a preferred embodiment of the present invention, the fabric softener concentrate of the present invention contains from about 2 to about 20 weight % of the at least one anionic scavenger and from about 80 to about 98 weight % of the at least one triglyceride-based ester quat. In a more highly preferred embodiment of the present invention, the fabric softener concentrate of the present invention contains from about 5 to about 15 weight % of the at least one anionic scavenger and from about 85 to about 95 weight % of the at least one triglyceride-based ester quat.

[0019] The anionic scavenger employed in the present invention is any compound that is capable of increasing the amount of cationic softening agent present in the laundry liquor by complexing with the anionics therein.

[0020] Examples of anionic scavengers that can be employed in the present invention include, but are not limited to:

(i) Mono-long chain alkyl-containing quaternary ammonium compounds having the formula:

$$[R^5àN^+à(R^6à)_3]X^-à$$

wherein $R^5à$ is a C_{8-22} alkyl or alkenyl group, preferably C_{12-18} alkyl or alkenyl, and even more preferably a C_{16-18} alkyl or alkenyl; each $R^6à$ is a C_{1-6} alkyl group, benzyl, hydrogen or a polyethoxylated chain with from 2 to 20 oxyethylene units; and X is an anion such as chloride, bromide, methyl sulfate, ethyl sulfate, formate, acetate, carbonate, sulfate, nitrate and other like anions.

[0021] Examples of the above mono-long chain alkyl-containing quaternary ammonium compounds include, but are not limited to: monolauryltrimethyl ammonium chloride, monotallow trimethylammonium chloride and monooleyl trimethyl ammonium chloride.

[0022] The $R^5à$ group can also be attached to the cationic nitrogen atom through a group containing one or more ester, amide, ether, amine, etc., linking groups. Such linking groups are preferably with 1 to 4 carbon atoms of the nitrogen atom.

(ii) Mono-alkyl cationic C_{8-22} alkyl choline esters having the formula:

$$R^5à\text{-}C(O)\text{-}O\text{-}CH_2CH_2N^+à(R^6à)_3X^-à$$

wherein $R^5à$, $R^6à$ and X are as defined hereinabove.

[0023] Illustrative examples of alkyl choline esters that can be employed in the present invention include, but are not limited to: C_{12-14} coco choline ester and C_{16-18} tallow choline ester.

(iii) Poly-quaternary ammonium compounds having the formula:

$$[R^9\text{-}N(R^8)\text{-}R^7\text{-}N(R^8)\text{-}R^9]\quad 2X^-$$

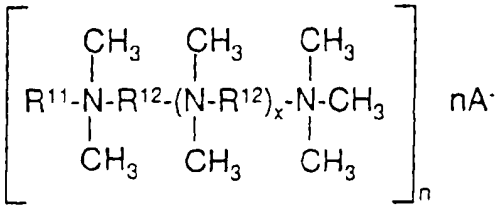
wherein $R^7à$ is substituted or unsubstituted C_{2-12} alkylene, substituted or unsubstituted C_{2-12} hydroalkylene; each $R^8à$ is independently C_{1-4} alkyl, each $R^9à$ is independently C_{1-22} alkyl, C_{8-22} alkenyl, $R^{10}à\text{-}Q\text{-}(CH_2)_m\text{-}$, where $R^{10}à$ is C_{1-22} alkyl, C_{8-22} alkenyl, and mixtures thereof; m is from 1 to 6; Q is a carbonyl unit; and X is an anion.

(iv) Amide quats having the formula:

$$R^{17}\text{-}C(=O)\text{-}N\text{-}(CH_2)_l\text{-}N\text{-}(R^{18})_3\ X^-$$

wherein $R^{17}à$ is a C_{8-22} alkyl, each $R^{18}à$ is the same or different and is a C_{1-4} alkyl, l is from 2 to 6, and X is an anion as defined above.

[0024] A highly preferred anionic scavenger employed in the present invention is a polyquat compound having the formula:



wherein R^{11}à is a C_{10-24}, preferably C_{16-18}, saturated or unsaturated alkyl, an ether having the formula R^{11}àOR^{13}à - where R^{11}à is as defined above and R^{13}à is a C_{1-6} hydrocarbyl group, preferably R^{13}à is a C_{2-4} alkyl, or an amido having the formula R^{11}àC(O)NR^{14}à-, where R^{11}à is as defined above and R^{14}à is a C_{2-6}, preferably a C_{2-3}, alkyl; R^{12}à is a C_{2-12}, preferably C_{2-3}, alkyl; x is 0-5, preferably 0 to 1; n is the number of moles of monovalent anion A to provide a net zero charge, preferably n is from 2 to 3; and A is a monovalent anion including, but not limited to: chloride, bromide, methyl sulfate, ethyl sulfate, formate, acetate, carbonate, sulfate, nitrate and other like anions, preferably A is chloride or methylsulfate.

[0025] Illustrative examples of suitable polyquats having R^{11}à equal to a C_{10-24} alkyl include, but are not limited to: tallow diquat and tallow triquat. Of these alkyl-containing polyquats, tallow diquat is most highly preferred.

[0026] Preferred examples of polyquats having R^{11}à equal to an ether (R^{11}àOR^{13}à-) include, but are not limited to: C_{12-18} ether propyl diquats. Of these ether-containing polyquats, C_{14-15} ether propyl diquats are highly preferred.

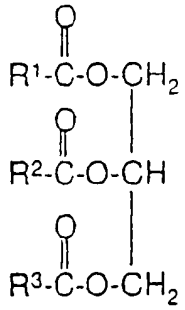
[0027] Illustrative examples of polyquats having R^{11}à equal to amido (R^{11}àC(O)NR^{14}à-) include, but are not limited to: tallow amidopropyl diquat and stearyl amidopropyl diquat. Of these amido-containing polyquats, stearyl amidopropyl diquat is preferred.

[0028] Of the various polyquats mentioned above, tallow diquat is most highly preferred. When tallow diquat is employed, the diquat is typically used in an amount of from about 5 to about 15 weight % in the rinse cycle fabric softener concentrate.

[0029] As stated above, the anionic scavenger increases the cationic charge in the laundry liquor by complexing with any anionic detergent species present therein. The anionic scavengers described above have a higher charge density as compared to the triglyceride-based ester quat present in the blend; therefore, the anionic scavengers have a higher affinity for complexing with the anionics present in the laundering liquor than the other quaternary ammonium compound present, i.e., triglyceride-based ester quat, in the rinse cycle fabric softener concentrate.

[0030] The triglyceride-based ester quat of the inventive fabric softener concentrate includes any ester quat that is produced by reacting an alkanol amine with a vegetable and/or an animal based fatty oil, i.e., triglyceride, to produce an ester amine and thereafter quaternizing the ester amine in the presence of an alkylating agent.

[0031] The triglyceride employed in the present invention in producing the triglyceride-based ester quat includes compounds having the formula:

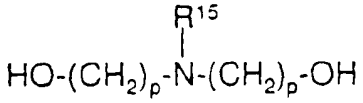


wherein R^{1}à, R^{2}à and R^{3}à are the same or different and are linear or branched, saturated or unsaturated, C_{9}-C_{21} alkyl or a linear or branched C_{1}-C_{4} alkyl, with the proviso that at least one of R^{1}à, R^{2}à or R^{3}à is a linear or branched C_{9}-C_{21} alkyl. In a preferred embodiment of the present invention, each R^{1}à, R^{2}à and R^{3}à is the same or different and is a C_{9}-C_{21} alkyl. In an even more preferred embodiment of the present invention, the triglyceride used in producing the triglyceride-based ester quat is a compound wherein R^{1}à is a C_{15}-C_{17} alkyl, R^{2}à is a C_{15}-C_{17} alkyl, and R^{3}à is a C_{15}-C_{17} alkyl.

[0032] Highly preferred triglyceride-based ester quats employed in the present invention are partially hydrogenated canola, partially hydrogenated tallow or partially hydrogenated palm stearine. When one of these highly

preferred triglyceride-based ester quats is employed, it is typically used in an amount of from about 85 to about 95 weight %.

[0033] The alkanol amines employed in producing the triglyceride-based ester quat is a compound having the following formula:



wherein R^{15} is a C_{1-18} alkyl or a $-(CH_2)_pOH$ group, and p is from 1 to 6. Illustrative examples of suitable alkanol amines that can be employed in the present invention include, but are not limited to: triethanol amine and methyldiethanol amine.

[0034] The mole ratio of triglyceride to alkanol amine employed in producing the triglyceride-based ester quat is from about 0.5:1 to about 1.5:1, preferably from about 0.6:1 to about 1:1, and most preferably from about 0.7:1 to about 1:1.

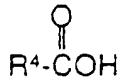
[0035] The alkanol amine and triglyceride are reacted togther under conventional esterification reaction conditions that are capable of producing an ester amine. For example, the esterification reaction may be carried out at temperature of from about 120°C to about 220°C under pressures from about 0.01 to about 1 bar. Other temperatures and pressures may also be used in the present invention.

[0036] The esterification reaction is carried out in the presence of a conventional esterification catalyst such as sodium hypophosphite. The catalyst employed in the esterification reaction is used in a catalytic effective amount of from about 0.01 to about 0.1%, by weight, based on the total weight of starting reactants. A conventional cocatalyst such as an alkaline metal and/or alkaline earth metal may be optionally used in the esterification reaction in amounts of from about 50 to about 1000 ppm.

[0037] Following esterification, the ester amine is subjected to a conventional quaternization process in the presence of an alkylating agent such as methyl chloride, dimethyl sulfate, diethyl sulfate, dimethyl carbonate, diethyl carbonate and other like compounds that are capable of alkylating the ester amine.

[0038] The quaternization reaction employed in the present invention typically uses a molar ratio of ester amine to alkylating agent of from about 1:0.95 to about 1:1.05, and the reaction may be carried out in the absence of water or in a small amount of solvent such as isopropyl alcohol (IPA).

[0039] In some embodiments of the present invention, the triglyceride may be used in conjunction with a fatty acid having the formula:



wherein R^4CO is an aliphatic, linear or branched acyl radical containing 5 to 21 carbon atoms, preferably 11 to 17 carbon atoms, and 0 and/or 1, 2 or 3 double bonds. Illustrative examples of fatty acids that fit the above formula include, but are not limited to: caproic acid, caprylic acid, 2-ethyl hexanoic acid, capric acid, lauric acid, isotridecanoic acid, myristic acid, palmitic acid, palmitoleic acid, stearic acid, isostearic acid, oleic acid, elaidic acid, petroselic acid, linoleic acid, linolenic acid, elaeostearic acid, arachic acid, gadoleic acid, behenic acid, erucic acid and mixtures thereof obtained, for example, by the high pressure hydrolysis of natural fats and oils, in the reduction of aldehydes from Roelen's oxosynthesis or in the dimerization of unsaturated fatty acids. Technical fatty acids (or so-called synthetic fatty acids) containing 12 to 18 carbon atoms such as coconut oil, palm oil, palm kernel oil or tallow fatty acids, preferably in hydrogenated or partially hydrogenated form, are especially preferred in the present invention.

[0040] When a fatty acid is employed, it is typically used in an amount so that the mole ratio of fatty acid to alkanol amine is from about 1.5:1 to about 2.7:1, more preferably, from about 1.7:1 to about 2.5:1. In a highly preferred embodiment of the present invention wherein a fatty acid is employed, the mole ratio of fatty acid to alkanol amine is from about 2:1 to about 2.2:1.

[0041] The rinse cycle fabric softener concentrate of the present invention is a blend of the above mentioned quaternary ammonium compounds that is made utilizing conventional processes that are well known to those skilled in the art for making fabric softeners. For example, the rinse cycle fabric softener concentrate of the present invention can be made by separately adding each ingredient to a reaction vessel. Mixing by hand, or with a mechanical mixer is typically carried out to ensure that a substantially homogeneous mixture of the components is obtained. The blend may be made at room temperature or, if desired, elevated temperatures can be employed. The ingredients of the blend may be added in a one shot process, or alternatively the ingredients may be added dropwise or in small incremental amounts.

[0042] Alternatively, the rinse cycle fabric softener concentrate of the present invention may be made by melting and mixing the individual components together utilizing melt mixing techniques that are well known to those skilled in

the art.

[0043] The rinse cycle fabric softener concentrate of the present invention may be made into a liquid fabric softener formulation by introducing the same into a liquid carry under high shear mixing conditions. The mixing may be conducted at room temperature, or alternatively, temperatures of from 40°C to 90°C can be employed.

[0044] Suitable liquid carries that may be employed in the present invention include, but are not limited to, water; C_{1-4} monohydric alcohols; C_{2-15} polyhydric glycols, diols, or triols; polyalkenylene glycols; and mixtures and combinations thereof.

[0045] In embodiments wherein the inventive rinse cycle fabric softener concentrate is used with a liquid carrier, the inventive rinse cycle fabric softener concentrate is present in a concentration of from about 20 to about 40 weight %.

[0046] In addition to liquid carries, the inventive rinse cycle fabric softener concentrate may be used with other conventional materials that are typically present in liquid rinse cycle fabric softeners. For example, brighteners, soil removers, solvotropes, perfumes, dyes, bactericides, chelating agents, silicones, and the like may be present in the liquid fabric softener formulation of the present invention. The only limitation on the liquid fabric softener of the present invention is that it contains at least the inventive rinse cycle fabric softener concentrate therein. Since the rinse cycle fabric softener concentrate of the present invention is capable of efficiently inhibiting dye transfer, there is no need to add a separate dye transfer inhibition agent into the inventive liquid rinse cycle fabric softener formulation.

[0047] The rinse cycle fabric softener concentrate or formulation of the present invention can be added during the rinse cycle of a laundering process wherein any detergent is present in the laundry liquor. That is, the inventive rinse cycle fabric softener concentrate or formulation can be added to a laundering liquor that contains anionic surfactants, non-ionic surfactants, amphoteric surfactants, zwitterionic surfactants or any combinations or mixtures thereof.

[0048] In a preferred embodiment of the present invention, the inventive rinse cycle fabric softener concentrate or formulation may be used with any conventional detergent that includes a high level of anionic surfactants present therein. That is, the rinse cycle fabric softener concentrate or formulation of the present invention is used with a detergent that contains from about 10 to about 80 weight % of at least one anionic surfactant present therein. More preferably, the detergent contains from about 30 to about 70 weight % of at least one anionic surfactant present therein.

[0049] Suitable anionic surfactants that can be employed in the detergent composition include water soluble salts, preferably the alkali metal, ammonium and alkylammonium salts of organic sulfuric acid reaction products having in their molecular structure an alkyl group containing from about 10 to about 20 carbon atoms and a sulfonic acid or sulfuric acid ester group. (Included in the term "alkyl" is the alkyl portions of acyl groups).

[0050] Some illustrative examples of the above type of anionic surfactants are the sodium and potassium alkyl sulfates, especially those obtained by sulfating higher C_{8-18} alcohols, such as those produced by reducing the glycerides of tallow or coconut oil; and the sodium and potassium alkylbenzene sulfonates in which the alkyl group is straight chained or branched, and the alkyl contains from about 9 to about 15 carbon atoms. The alkylbenzene sulfonates of the former type are described, for example, in U.S. Patent Nos. 2,220,099 and 2,477,383, the contents of each reference is incorporated herein by reference.

[0051] Especially preferred alkylbenzene sulfonates are linear straight chain alkylbenzene sulfonates in which the average number of carbon atoms in the alkyl group is from about 10 to 15, abbreviated as C_{10-15} LAS. The alkali salts, particularly the sodium salts of these anionic surfactants are preferred. Alkylbenzene sulfonates and processes for producing the same are disclosed, for example, in U.S. Patent No. 2,220,099 and 2,477,383.

[0052] Other anionic surfactants that can be employed in the detergent composition include alkyl alkoxylated sulfates. These compounds are water-soluble salts or acids having the formula $R^{16}{}_{a}O(Y)_qSO_3M$ wherein $R^{16}{}_{a}$ is an unsubstituted C_{10-24} alkyl or hydroxyalkyl group having a C_{10-18} alkyl or hydroxyalkyl group, Y is an ethoxy or propoxy unit, q is greater than zero, preferably q is between about 0.5 and about 6, and M is hydrogen or a water soluble cation which can be, for example, a metal cation (e.g., sodium, potassium, lithium, calcium, magnesium, etc.), ammonium or substituted-ammonium cation. Specific examples of substituted ammonium cations include, but are not limited to, methyl-, ethyl-, dimethyl-, trimethyl-ammonium and quaternary ammonium cations, such as tetramethyl-ammonium, dimethyl piperdinum and cations derived from alkanol amines such as monoethanol amine, diethanol amine and triethanol amine, and mixtures thereof.

[0053] Illustrative examples of the foregoing alkyl alkoxylated sulfates include: C_{12-18} alkyl polyethoxylate (1.0) sulfate, C_{12-18} alkyl polyethoxylate (2.25) sulfate, C_{12-18} alkyl polyethoxylate (3.0) sulfate, C_{12-18} alkyl polyethoxylate (4.0) sulfate, wherein M is sodium or potassium.

[0054] Other anionic surfactants useful in the detergent composition include sodium alkyl glyceryl ether sulfonates, particularly those ethers of higher alcohols derived from tallow and coconut oil; sodium coconut oil fatty acid monoglyceride sulfonates and sulfates.

[0055] Still further anionic surfactants include water-soluble salts of esters of alpha-sulfonated fatty acids containing from about 6 to about 20 carbon atoms in the fatty acid portion of the compound and from 1 to about 10 carbon atoms in the ester group; water-soluble salts of 2-acyloxyalkane-1-sulfonic acids containing from about 2 to about 9 carbon atoms in the acyl portion of the compound and from about 9 to about 23 carbon atoms in the alkane moiety; water-soluble salts of olefin and paraffin sulfonates containing from about 12 to about 20 carbon atoms; and beta-alkyloxy alkane sulfonates containing from 1 to about 3 carbon atoms in the alkyl group and from about 8 to about 20 carbon atoms in the alkane moiety.

[0056] In addition to anionic surfactants, the detergent may optionally include one or more nonionic surfactants therein. Typical nonionic surfactants that can be present in the detergent composition include polyethylene, polypropylene and polybutylene oxide condensates of alkyl phenols. Other examples of nonionic surfactants include: condensation products of primary and secondary aliphatic alcohols, alkylpolysaccharides, condensation products of ethylene oxide with a hydrophobic base formed by the condensation of propylene oxide with propylene glycol, condensation products of ethylene oxide with the product resulting from the reaction of propylene oxide and ethylenediamine, and polyhydroxy fatty acid amides.

[0057] The detergent may also include any conventional amphoteric or zwitterionic surfactant therein. It is noted the use of the inventive rinse cycle fabric softener formulation is not limited to a specific type of detergent, but rather the rinse cycle fabric softener formulation of the present invention can be used with any conventional detergent.

[0058] In addition to the above ingredients, the detergent composition may also include conventional detergent builders, enzymes, bleaching agents, bleach activators, polymeric soil release agents, chelating agents, soil release and anti-redeposition agents, dispersing agents, optical brighteners, whitening agents, betaines, sultanies and other like components that may be typically used in laundry detergents. Since all these compounds are conventional, a detailed description of the optional components is not provided herein. A detailed description of these detergent components however can be found in WO 98/53034, the contents of which is incorporated herein by reference.

Operational Use:

[0059] The rinse cycle fabric softener concentration or formulation of the present invention is typically added to the rinse cycle of a laundry process utilizing conventional washing temperatures of about 20°C to about 60°C and rinsing temperatures of about 10°C to about 50°C. The rinse cycle fabric softener concentrate or formulation of the present invention is effective over a wide range of water hardness levels.

[0060] The rinse cycle fabric softener concentrate or formulation of the present invention may be used in laundering operations by adding the formulation to a laundering vessel in amounts that are typically used. Specifically, the inventive rinse cycle formulation of the present invention is used in an amount of from about 20 g to about 120 g solids content of fabric softener with a 3 to 8 pound load of clothing to be washed. The particular amount of fabric softener used in the rinsing cycle is not however critical to the present invention.

[0061] The following examples are given to illustrate the present invention and to demonstrate some advantages that can be obtained from utilizing the same.

[0062] In the examples, dye transfer inhibition was determined by measuring the average delta E utilizing ASTM Test No. D-5548-94, "Evaluating Color Transfer or Color Loss of Dyed Fabric in Home Laundry", the content of which is incorporated herein by reference. Specifically, swatches of nylon fabric dyed with Acid Red 151, and cotton fabric dyed with either Direct Blue 90 or Direct Blue 1, were washed under standardized, identical conditions (90 rpm, 40 minutes, about 50°C, water hardness about 110 rpm) together with a swatch of undyed (white) cotton fabric (swatches dyed with different dyes were not washed together). The washed, dyed and undyed, swatches were recovered, rinsed in 20°C rinse water and air dried.

[0063] The surface reflectance, the redness/greenness, and the yellowness/blueness, of the white swatches were measured by a colorimeter both before and after washing, under conditions identical for each swatch. The total color difference ("delta E") is calculated from the following equation:

$$\text{delta } E = ((L_w - L_o)^2 + (a_w - a_o)^2 + (b_w - b_o)^2)^{1/2}$$

wherein L = reflectance; a = redness/greenness; b = yellowness/blueness; w = fabric before washing; and o = fabric after washing.

[0064] A lower delta E value represents less dye transfer and thus a better performing product.

[0065] Softness was tested by utilizing standard North American washing conditions. Specifically, a Kenmore washing machine and a Kenmore electrical dryer were used. Washing was carried out as follows:

Warm Wash (33°C)

Cold Rinse (11°C)

45 grams of a commercially available anionic-containing detergent

1700 grams of fabric (Cotton terry towels and Sheets)

Softener Dosage = 0.25 % based on softener actives per weight of fabric

Softness was ranked from softest to hardest using a panel containing 8 members. In the examples, a ranking of 3 represents the best result.

EXAMPLE 1

[0066] In this example, the softening performance of various samples were tested utilizing the above procedure. Specifically, the following three samples were tested:

Sample	Softening Performance
Tallow based TEA ester quat from a fatty acid; Prior art	2.1
TEA ester quat from tallow (triglyceride); Prior art	1.1
55% TEA ester quat from tallow (triglyceride) and 15% Tallow based diquat (Adogen® 477) (50% IPA/H_2O) ; Invention	2.9

[0067] The results in the above table demonstrate that the inventive rinse cycle fabric softener has improved softening properties compared to prior art rinse cycle fabric softeners.

EXAMPLE 2

[0068] In this example, the dye transfer inhibition property of various samples were tested utilizing the above procedure. Specifically, the following three samples were tested:

Sample	Delta E
Tallow based TEA ester quat from talow fatty acid; Prior art	6.4
TEA ester quat from tallow (triglyceride); Prior art	7.5
55% TEA ester quat from tallow (triglyceride) and 15% Tallow based diquat (Adogen® 477) (50% IPA/H_2O) ; Invention	5.0

[0069] The results in the above table demonstrate that the inventive rinse cycle fabric softener has improved dye transfer inhibition (representative by the lower delta E) compared to prior art rinse cycle fabric softeners.

[0070] While the present invention has been particularly shown and described with respect to preferred embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and detail may be made without departing from the spirit and scope of the present invention. It is therefore intended that the present invention not be limited to the exact forms described and illustrated, but fall within the scope of the appended claims.

Claims

1. A rinse cycle fabric softener concentrate comprising a blend of (i) about 1 to about 50 weight % of at least anionic scavenger; and (ii) about 50 to about 99 weight % of at least one triglyceride-based ester quat.

2. The rinse cycle fabric softener concentrate of Claim 1 wherein said blend comprises from about 2 to about 20 weight % of said anionic scavenger and from about 80 to about 98 weight % of said triglyceride-based ester quat.

3. The rinse cycle fabric softener concentrate of Claim 2 wherein said blend comprises from about 5 to about 15 weight % of said anionic scavenger and from about 85 to about 95 weight % of said triglyceride-based ester quat.

4. The rinse cycle fabric softener concentrate of Claim 1 wherein said anionic scavenger is a compound having the following formula:

$$[R^5\grave{a}N^+\grave{a}(R^6\grave{a})_3]X^-\grave{a}$$

wherein $R^5\grave{a}$ is a C_{8-22} alkyl or alkenyl group, each $R^6\grave{a}$ is a C_{1-6} alkyl group, benzyl, hydrogen or a polyethoxylated chain with from 2 to 20 oxyethylene units; and X is an anion.

5. The rinse cycle fabric softener concentrate of Claim 4 wherein said anionic scavenger is monolauryltrimethyl ammonium chloride, monotallow trimethylammonium chloride or monooleyl trimethyl ammonium chloride.

6. The rinse cycle fabric softener concentrate of Claim 1 wherein said anionic scavenger is a compound having the

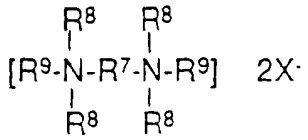
following formula

$$R^5à\text{-}C(O)\text{-}O\text{-}CH_2CH_2N^+à(R^5à)_2X^-à$$

wherein $R^5à$ is a C_{13-22} alkyl or alkenyl group; each $R^5à$ is a C_{1-6} alkyl group, benzyl, hydrogen or a polyethoxylated chain with from 2 to 20 oxyethylene units; and X is an anion.

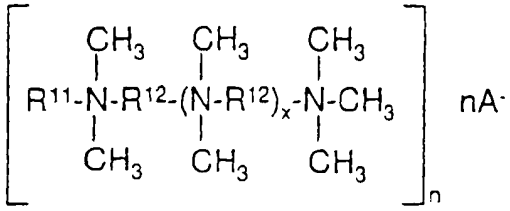
7. The rinse cycle fabric softener concentrate of Claim 6 wherein said anionic scavenger is a C_{12-14} coco choline ester or a C_{16-18} tallow choline ester.

8. The rinse cycle fabric softener concentrate of Claim 1 wherein said anionic scavenger is a compound having the following formula:



wherein $R^7à$ is substituted or unsubstituted C_{2-12} alkylene, substituted or unsubstituted C_{2-12} hydroalkylene, each $R^8à$ is independently C_{1-4} alkyl, each $R^9à$ is independently C_{1-22} alkyl, C_{8-22} alkenyl, $R^{10}à\text{-}Q\text{-}(CH_2)_m\text{-}$, where $R^{10}à$ is C_{1-22} alkyl, C_{8-22} alkenyl, and mixtures thereof, m is from 1 to 6, Q is a carbonyl unit, and X is an anion.

9. The rinse cycle fabric softener concentrate of Claim 1 wherein said anionic scavenger is a compound having the following formula:



wherein $R^{11}à$ is a C_{10-24} saturated or unsaturated alkyl, an ether having the formula $R^{11}àOR^{13}à$ - where $R^{11}à$ is as defined above and $R^{13}à$ is a C_{1-6} hydrocarbyl group, or an amido having the formula $R^{11}àC(O)NR^{14}à\text{-}$, where $R^{11}à$ is as defined above and $R^{14}à$ is a C_{2-6}; $R^{12}à$ is a C_{2-12} alkyl; x is 0-5; n is the number of moles of monovalent anion A to provide a net zero charge; and A is a monovalent anion.

10. The rinse cycle fabric softener concentrate of Claim 9 wherein said anionic scavenger is a compound wherein $R^{11}à$ equal to a C_{10-24} alkyl.

11. The rinse cycle fabric softener concentrate of Claim 10 wherein said compound is tallow diquat or tallow triquat.

12. The rinse cycle fabric softener concentrate of Claim 11 wherein said compound is tallow diquat.

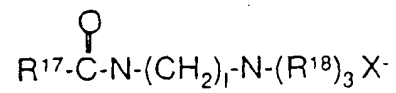
13. The rinse cycle fabric softener concentrate of Claim 9 wherein said anionic scavenger is a compound wherein $R^{11}à$ equal to an ether ($R^{11}àOR^{13}à\text{-}$).

14. The rinse cycle fabric softener concentrate of Claim 13 wherein said compound is a C_{12-15} ether propyl diquat.

15. The rinse cycle fabric softener concentrate of Claim 9 wherein said anionic scavenger is a compound wherein $R^{11}à$ equal to amido ($R^{11}àC(O)NR^{14}à\text{-}$).

16. The rinse cycle fabric softener concentrate of Claim 15 wherein said compound is tallow amidopropyl diquat or stearyl amidopropyl diquat.

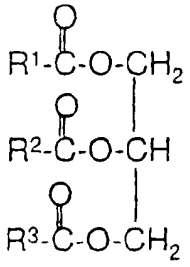
17. The rinse cycle fabric softener concentrate of Claim 1 wherein said anionic scavenger is a amide quat having the following formula



wherein R^{17}à is a C_{7-22} alkyl, each R^{18}à is the same or different and is a C_{1-4} alkyl, 1 is from 2 to 6, and X is an anion.

18. The rinse cycle fabric softener concentrate of Claim 1 wherein about 5 to about 15 weight % of tallow diquat is present in the rinse cycle fabric softener concentrate.

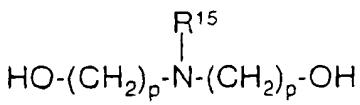
19. The rinse cycle fabric softener concentrate of Claim 1 wherein said triglyceride-based ester quat is a compound produced by esterifying an alkanol amine and a triglyceride having the formula



wherein R^{1}à, R^{2}à and R^{3}à are the same or different and are linear or branched, saturated or unsaturated, C_9-C_{21} alkyl or a linear or branched C_1-C_4 alkyl, with the proviso that at least one of R^{1}à, R^{2}à or R^{3}à is a linear or branched C_9-C_{21} alkyl, to produce an ester amine and thereafter quaternizing the ester amine in the presence of an alkylating agent.

20. The rinse cycle fabric softener concentrate of Claim 19 wherein R^{1}à is a C_{15-17} alkyl, R^{2}à is a C_{15-17} alkyl, and R^{3}à is a C_{15-17} alkyl.

21. The rinse cycle fabric softener concentrate of Claim 19 wherein said alkanol amine is a compound having the following formula:



wherein R^{15}à is a C_{1-18} alkyl or a $-(CH_2)_pOH$ group, and p is from 1 to 6.

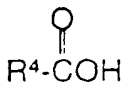
22. The rinse cycle fabric softener concentrate of Claim 21 wherein said alkanol amine is triethanol amine or methyldiethanol amine.

23. The rinse cycle fabric softener concentrate of Claim 19 wherein said triglyceride-based ester quat is produced using a mole ratio of triglyceride to alkanol amine of from about 0.5:1 to about 1.5:1.

24. The rinse cycle fabric softener concentrate of Claim 23 wherein said mole ratio of triglyceride to alkanol amine is from about 0.6:1 to about 1:1.

25. The rinse cycle fabric softener concentrate of Claim 24 wherein said mole ratio of triglyceride to alkanol amine is from about 0.7:1 to about 1:1.

26. The rinse cycle fabric softener concentrate of Claim 19 wherein said triglyceride includes a fatty acid having the following formula:



wherein $R^{1}_{a}CO$ is an aliphatic, linear or branched acyl radical containing 5 to 21 carbon atoms and 0 and/or 1, 2 or 3 double bonds.

27. The rinse cycle fabric softener concentrate of Claim 1 wherein said anionic scavenger is tallow diquat and said triglyceride-based ester quat is from partially hydrogenated canola, partially hydrogenated tallow or partially hydrogenated palm stearine.

28. The rinse cycle fabric softener concentrate of Claim 27 wherein said tallow diquat is used in an amount of from about 5 to about 15 weight % and triglyceride-based ester quat is used in an amount of from about 85 to about 95 weight %.

29. A liquid rinse cycle fabric softener formulation comprising at least the rinse cycle fabric softener concentrate of Claim 1.

30. The liquid rinse cycle fabric softener formulation of Claim 29 further comprising a liquid carrier.

31. The liquid rinse cycle fabric softener formulation of Claim 30 wherein said liquid carrier is water, a C_{1-4} monohydric alcohol, a C_{2-10} polyhydric glycol, diol or triol, a polyalkenylene glycol, or combinations and mixtures thereof.

32. The liquid rinse cycle fabric softener formulation of Claim 30 wherein said rinse cycle fabric softener concentrate is present in an amount of from about 2 to about 40 weight %.

33. The rinse cycle fabric softener formulation of Claim 29 wherein said anionic scavenger is tallow diquat and said triglyceride-based ester quat is from partially hydrogenated canola, partially hydrogenated tallow or partially hydrogenated palm stearine.

34. The rinse cycle fabric softener concentrate of Claim 33 wherein said tallow diquat is used in an amount of from about 5 to about 15 weight % and said triglyceride-based ester quat is used in an amount of from about 85 to about 95 weight %.

35. A method of laundering fabrics comprising the steps of:

(a) washing a fabric in water in the presence of a detergent, and

(b) rinsing the washed fabric of step (a) in the presence of at least the rinse cycle fabric softener concentrate of Claim 1, said rinse cycle fabric softener concentrate is effective in providing improved softness and dye inhibition to said fabric.

36. The method of Claim 35 wherein said detergent is comprised of at least one anionic surfactant.

37. The method of Claim 35 wherein said anionic scavenger is tallow diquat and said triglyceride-based ester quat is partially hydrogenated canola, partially hydrogenated tallow or partially hydrogenated palm stearine.

38. The method of Claim 37 wherein said tallow diquat is used in an amount of from about 5 to about 15 weight % and triglyceride-based ester quat is used in an amount of from about 85 to about 95 weight %.

39. A clear rinse cycle fabric softener concentrate comprising at least one anionic scavenger and at least one oil-based ester quat selected from triglycerides containing unsaturated fatty acids having 0, 1, 2 or 3 double bonds and an iodine value of from 40 to 150.

40. The clear concentrate of Claim 39 wherein said oil-based ester quat is formed from canol or soybean.

41. A clear rinse cycle fabric softener formulation comprising at least the clear rinse cycle fabric softener concentrate of Claim 39.

42. The clear rinse cycle fabric softener formulation of Claim 41 further comprising a liquid carrier and optionally at least one surfactant and/or a detergent salt.